The Bogalusa Brand

Select Long Leaf Pine Structural Timbers

50°

Typical of Long Leaf Timber From Which BOGALUSA Brand Timbers Are Cut

Select Structural Material

Its Characteristics and Uses

Manufactured from
Genuine Long Leaf Pine (*Pinus palustris*)

by the

Great Southern Lumber Company

Bogalusa, Louisiana

Select Structural Material

SOUTHERN yellow pine timber resists, in an exceptional degree, *all* of the stresses developed in structures. These stresses are tension, compression parallel and perpendicular to the grain and shear parallel to the grain. Wood is the only natural structural material that has the ability to resist all of these stresses in the right proportions. The physical properties of the southern yellow pines are so scientifically adjusted by nature that these species are used for structural purposes to a greater extent than all of the others.

It is a natural law, correspondent to the coniferous woods, that the strength varies with the specific dry weight and density.

It is the quality of great density and specific dry weight that makes the longleaf species the strongest of the structural woods. This is supplemented by a straight grain and a comparative freedom from serious defects. This species is also distinguished by a large resin content and small percentage of sap wood. It is these qualities that make it the most durable of woods when exposed to the elements or to conditions of high constant temperature and relatively high humidity.*

Longleaf pine (*Pinus palustris*) is eminently qualified for use in bridges and trestles where great strength and durability are essential. Timbers for such structures must show a large percentage of heartwood and the other properties required by the Standard Specifications for Southern Yellow Pine Bridge and Trestle Timbers adopted by the American Railway Engineering Association. It is also adapted for use in factories and warehouses where great strength is required and in textile mills where durability and resistance to dry rot are the essential factors. It is the strongest because it is the most dense and the most durable because the most resinous.

The use of wood for structural purposes is confined almost exclusively to the conifers. The annual cut of coniferous wood in the United States is thirty-four billion feet, board measure, which is 76 per cent of the total cut, including the hardwoods. Of the coniferous woods cut, the Southern Yellow Pines amount to 37 per cent, or four times as much as the most plentiful competing wood. The predominating species of these woods are the longleaf and shortleaf; 232.3 billion feet of longleaf and 152.1 billion feet of shortleaf and loblolly, contributing to the total of 634 billion feet of standing timber in the Southern Pine region; cypress 40.4 billion feet; and all hardwoods together, 209.2 billion feet.**

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*See Mechanical Properties of Woods Grown in the United States, United States Forest Service, Circular 213; The Mechanical Properties of Wood, by Prof. S. J. Record; Lumber and Its Uses, by R. S. Kellogg.

**The Lumber Industry, Part I, Standing Timber, Department of Commerce and Labor, Bureau of Corporations, 1913.

Steam Skidders and Loaders are Important Factors in the Logging Operation at BOGALUSA

It is a recognized fact that the type of building construction known as "standard mill" possesses advantages not equaled by any other type of construction when used for factories, warehouses and other commercial purposes. These advantages are economy in cost of construction, and a very high degree of fire resistance when built and equipped with automatic sprinklers as specified by the Associated Factory Mutual Fire Insurance Companies. One of the greatest advantages of this type of construction is that such buildings are flexible; they can be easily altered for different kinds of occupancy. This is not the case with the fixed and inflexible concrete building.

With the rapid growth of American cities and the changing character of localities it is often necessary to remove perfectly good structures. A notable example was the demolition and rebuilding of the Albert Dickinson Company's extensive warehouses in Chicago. After being in use twenty-two years every piece of Southern Yellow Pine Timber was reused in the new plant.

The fire hazard to buildings and contents, in properly constructed and equipped buildings of this type, does not exceed that in buildings of any other type used for the same purposes. *For buildings of standard mill construction, a long and satisfactory experience with Southern Longleaf Yellow Pine demonstrates the unchallenged superiority of that wood.*

One of the Big Combination Steam Skidder-Loaders that Keep the BOGALUSA Plant Supplied with Raw Material

The strength of Southern Long Leaf Yellow Pine is not affected by preserving with creosote,* while some other coniferous woods show a marked loss in strength after receiving this treatment.**

SOUTHERN YELLOW PINE

Standard Specifications and Grading Rules

HOW can the architect or engineer secure the best results in using this material? First, by selecting the proper grade of material according to any of the specifications hereinafter mentioned, and suitable for the use to which the material is to be put.

The standardization of the manufacture and grading of Southern Yellow Pine originated about twenty years ago in the Southern Lumber Manufacturers' Association, which organization was succeeded by the Yellow Pine Manufacturers' Association and the Southern Pine Association. This organization was always in the lead in this work but during this time the standardization of manufacture and grading was also undertaken by the Atlantic Coast Association, which originated what are known as the Interstate Rules of 1905.

*See Bulletin 149. American Railway Engineering Association.
**See Bulletin 168. American Railway Engineering Association.

The Saw Mill and Log Pond. These Long Leaf Logs Make BOGALUSA Brand Timbers

All of these standard grading rules were based on a permissible maximum number of defects and disregarded entirely the strength and durability of the wood. Hence we have such grades as Standard, Merchantable and Prime on the Atlantic coast and the old grades of No. 1 and No. 2 common in the central portion of the country. In no case do these rules provide for the necessities of the architect and engineer, inasmuch as they do not fix any strength value and it is principally strength and durability with which structural experts are concerned.

As a result of these unscientific grading rules it has been difficult to procure a satisfactory material having a dependable and uniformly measurable strength; this situation causing engineers and architects to use other materials of construction. Such difficulty in securing suitable material finally led to a demand on the part of those writing specifications for a grading rule based on strength quality.

The first effort to meet with this demand was that of the American Railway Engineering Association, always a leader in engineering progress, whose members in 1909 adopted the standard specification for bridge and trestle timbers. Early in 1914 the Forest Service, United States Department of Agriculture, made a

Handling Long Leaf Structural Timbers on the Timber Dock at BOGALUSA

Heavy Long Leaf Timbers of Exceptional Quality Bearing the BOGALUSA Brand

rule to govern the purchases of yellow pine used in the construction of the Panama Canal. On May 4, 1914, a committee of the Yellow Pine Manufacturers' Association approved a rule for "structural grades" based on the density and strength quality of the wood. This action was followed shortly thereafter by the Georgia-Florida Saw Mill Association by the adoption of a similar rule adapted to the forests controlled by that association.

The latest rules to be adopted are those of the Southern Pine Association, in 1915, which are based largely on the investigations and recommendations of the Forest Service. On March 15, 1915, the Inspection Department of the Associated Factory Mutual Fire Insurance Companies issued specifications for a special grade of longleaf pine for use in Mutual factories. These specifications provide for branding the material at the mill and are complete in that they grade for durability as well as strength. They are based on the results of investigation of a large number of recent cases of dry rot in factories in which defective material had been used.

In subsequent pages are given the current grading rules as follows:

(1) Specifications of the Associated Factory Mutual Fire Insurance Companies of 1915. (These specifications call for the very highest grade of structural timbers.)

(2) Select Structural Grade adopted by the American Society for Testing Materials and the Southern Pine Association, 1915.

(3) Standard Grades of the Southern Pine Association, adopted 1915.

(4) Standard Grades of the American Railway Engineering Association, adopted 1909.

The Standard Specification for Yellow Pine Bridge and Trestle Timbers adopted by the American Society for Testing Materials, September 1, 1910, is in effect identical with that of the American Railway Engineering Association and the suggested rule of the United States Forest Service and the rule of the Georgia-Florida Saw Mill Association (adopted in 1914) are similar to, but not so specific as that adopted by the Southern Pine Association. The Interstate Rules of 1905 are no longer in accord with approved engineering practice; hence these rules are omitted.

Southern Yellow Pine is manufactured to conform to the standard sizes and dressing of the Southern Pine Association. For the use of engineers and architects a table of the nominal and actual sizes has been prepared, to which has been added data concerning the properties of the sections. This data is of the same kind that is used in connection with steel construction and affords the designer in wood construction the same facilities for accurate work.*

Branded material safeguards the purchaser and the writer of the specification by locating the source of supply and the responsibility of the inspection service.

After selecting the grade and specification, the designer should further require that the material bear the brand BOGALUSA, which signifies that the material is genuine longleaf pine (*Pinus palustris*) properly manufactured and carefully graded.

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*See pages 20–23.

Select Long Leaf Timbers are Always in Plentiful Supply at BOGALUSA

Every Timber on the Dock is Branded BOGALUSA, Signifying Long Leaf Pine Material of the Best Quality

SOUTHERN LONG LEAF YELLOW PINE

Where to Get it.

THE GREAT SOUTHERN LUMBER COMPANY, located at BOGALUSA, Louisiana, is satisfying the growing demand for a scientifically graded and branded material of uniform quality by applying the dependable brand BOGALUSA to it products. Thus branded, this company is prepared to furnish longleaf yellow pine, every stick of which conforms to the grades mentioned whether domestic or export.

The enormous output of the Bogalusa Mills makes the most uniform grading of structural timber not only possible, but highly practicable.

The mills of the GREAT SOUTHERN LUMBER COMPANY at BOGALUSA, are the largest in the world, with a daily capacity of 1,000,000 board feet of manufactured lumber, a large part of this output being composed of heavy structural timbers.

The extensive forests owned by the GREAT SOUTHERN LUMBER COMPANY consist of virgin tracts of southern longleaf yellow pine, enabling it to furnish lumber and structural timber conforming to the most rigid specifications. This

Company's holdings insure its ability to supply such material for many years.

A large modern wood preserving plant is an important department in the Bogalusa organization. By use of chemical treatment good material can be made more durable under exceptionally trying conditions and sappy material which is strong can be made serviceable by increasing its durability. Many of the dry rot cases reported have resulted from sappy, non-resinous material which became infected with dry rot germs before being put into the structure. This would have been prevented if this same sappy material had been given a reliable chemical treatment after being sawn before the germs had obtained an entrance.

STANDARD SPECIFICATIONS FOR SOUTHERN YELLOW PINE

Specifications Suggested for a Special Grade of Longleaf Pine for Use in Mutual Factories*

In making contracts for beams, columns and plank to be used in "Slow Burning Construction," the following specifications are recommended:

Density. No part of the material shall have a density of less than 30 pounds per cubic foot when tested by boring smooth holes one inch in diameter and two inches deep in the ends of the stick, drying to constant weight at 212° F. and weighing the borings and computing the density from the volume of the hole.

Rosin. None of the heartwood shall show less than four per cent of rosin by weight when borings are taken with a one inch bit with a hole two inches deep, dried to constant weight at 212° F. and extracted with benzole, the extracted rosin evaporated until it is not soft or sticky when touched with the finger at 70° F.

Heartwood. Heartwood shall show in all four faces of every stick, and sapwood shall not extend more than two inches from the corner at any place, measured perpendicularly to the corner across the face.

Growth Rings. For timbers 6 x 8 inches, or larger, there must show on the cross section between the third and fourth inch, measured radially from the heart center or pith, not less than six annual rings of growth, a majority of which shall show at least one-third summerwood, which is the dark portion of the annual rings; but wide ringed material excluded by this rule will be acceptable, providing that in the majority of the annual rings the dark ring is hard and in width equal to or greater than the adjacent light colored ring.

For pieces in which the center is not included, there must show on the cross section, an average of not less than six annual rings of growth, with not less than one-third summerwood. Timbers will be rejected in which there is no sharp contrast in color between the springwood and summerwood.

Defects. No timber with knots greater than one inch in diameter, or rot, or injurious shakes will be accepted.

Branding. Longleaf pine sold under this specification shall be branded with the letters "F. M.," the name of the lumber manufacturer, the location of the sawmill from which it comes, and the date of sawing, in letters at least one inch high.

Specifications for Southern Yellow Pine Timbers, Adopted by The Southern Pine Association, October, 1915

TIMBER GRADES

The grades of timber are as follows:

"Select Structural Material."	"Square Edge and Sound Timbers."
"Merchantable Timbers."	"No. 1 Common Timbers."

GENERAL TIMBER SPECIFICATIONS

All timber except No. 1 Common must be free from defects such as injurious ring or round shakes, and through shakes that extend to the surface; unsound and loose knots, and knots in groups that will materially impair the strength. Seasoning checks and discolored sap shall not be considered defects in any grade.

Knots

Knots shall be classified as round and spike in form and for quality as sound, encased, loose and unsound.

A *round knot* is oval or circular in form.

A *spike knot* is one sawn in a lengthwise direction.

A *sound knot* is one solid across its face, is as hard as the wood which surrounds it, may be either red or black, and fixed by growth or position so that it will retain its place in the piece.

An *encased knot* is one surrounded in whole or in part by pitch or bark and when grown fast to the piece or fixed by position so that it will retain its place in the piece it shall be considered a sound knot.

A *loose knot* is one not held firmly in place by growth or position.

An *unsound knot* is one not as hard as the wood surrounding it, or one having a hole in it.

*See "Dry Rot in Factory Timbers," by F. J. Hoxie, 1915; Inspection Department Associated Factory Mutual Insurance Companies, Boston.

A General View of the Timber Dock at the BOGALUSA Plant

Wane

Wane is bark on the corner of the piece, or the absence of the corner.

Shakes

Shakes are cracks appearing on the ends of timbers, either intersecting the annual growth rings or separating the same. They shall be classified as ring or round shakes and through shakes.

A ring or round shake is an opening between the annual rings.

A through shake is one extending from the region of the center to the surface of the piece or extending between two faces.

Shakes not hereinbefore described unless known to have extensive penetration shall not be considered a defect under this classification.

Sizes and Lengths

All rough timber, except No. 1 Common, must be full size when green. One-quarter inch shall be allowed for each side surfaced.

Standard lengths are multiples of two feet, eight to twenty feet, inclusive. Extra lengths are multiples of two feet, twenty-two feet and longer. When lineal average is specified, standard of lengths shall be multiples of one foot.

GRADES

The grades of timber shall be designated as follows:

Select Structural Material.
Merchantable Timbers.
Square Edge and Sound Timbers.
No. 1 Common Timbers.

Heart Timbers

All timber specifications, except "Merchantable," specifying heart requirements, shall be considered as a special contract.

The Term "Commercial Long Leaf" is Unknown at BOGALUSA. These Branded Stocks are Genuine Long Leaf Pine

Select Structural Material

(A rule incorporating suggestions by the United States Forest Service. Adopted by the American Society for Testing Materials, Aug. 21, 1915. Copyright, 1915, American Society for Testing Materials.)

REQUIREMENTS FOR DENSITY AND RATE OF GROWTH

1. Shall contain only sound wood and be well manufactured.

2. Shall conform to the definition of dense Southern pine as adopted by the American Society for Testing Materials, August 21st, 1915, as follows:

Dense southern yellow pine shall show on either end an average of at least six annular rings per inch and at least one-third summer wood, or else the greatest number of rings shall show at least one-third summer wood, all as measured over the third, fourth and fifth inches on a radial line from pith.

Wide-ringed material excluded by this rule, will be acceptable, provided the amount of summer wood, as above measured, shall be at least one-half.

The contrast in color between summer wood and spring wood shall be sharp and the summer wood shall be dark in color except in pieces having considerably above the minimum requirement for summer wood.

For the purpose of determining whether any given piece meets the requirements for density and rate of growth, the following rule, suggested by the United States Forest Service, shall be applied. It will be sufficient if either end passes the inspection.

(1) Pith Present or Accurately Located.

(A) Radial line of 5″ present.

(a) Apply inspection over third, fourth and fifth inches.

(B) Radial line of 5″ not present.

Apply inspection to the second inch on 2x3, 2x4, 2x6, 3x3, 3x4, 4x4, or any other dimension material that has less than 16 square inches on the cross-section.

(b) In the larger material apply inspection to the 3 inches farthest from the pith.

The Pine Tree Inn at BOGALUSA, Maintained for the Comfort of the Great Southern Lumber Company's Visitors

(2) Pith Not Present or Cannot be Accurately Located.
 (A) Material over 3″ thick, apply inspection to three inches nearest the pith.
 (B) Dimension material 3″ or less in thickness, apply inspection to second inch of the piece nearest the pith.

(3) The Radial Line Chosen Shall Show a Representative Number of Annual Rings of Growth and Per Cent of Summerwood.

DEFINITION FOR SOUTHERN YELLOW PINE

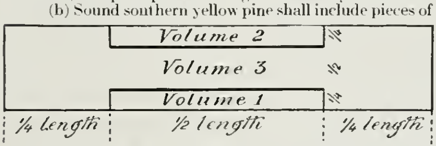
3. Southern Yellow Pine—This term includes the species of yellow pine growing in the Southern States from Virginia to Texas, that is, the pines hereto known as longleaf pine (*Pinus palustris*), shortleaf pine (*Pinus echinata*), loblolly pine (*Pinus taeda*), Cuban pine (*Pinus heterophylia*), and pond pine (*Pinus serotina*).

Under this heading two classes of timber are designated: (A) dense southern yellow pine and (B) sound southern yellow pine. It is understood that these two terms are descriptive of quality rather than of botanical species

(a) Dense southern yellow pine shall show on either end an average of at least six annual rings per inch and at least one-third summer wood, or else the greater number of the rings shall show at least one-third summer wood, all as measured over the third, fourth and fifth inches on a radial line from the pith. Wide-ringed material excluded by this rule will be acceptable, provided that the amount of summer wood as above measured shall be at least one-half.

The contrast in color between summer wood and spring wood shall be sharp and the summer wood shall be dark in color, except in pieces having considerably above the minimum requirement for summer wood.

(b) Sound southern yellow pine shall include pieces of southern pine without any ring or summer wood requirement.



RESTRICTIONS ON KNOTS IN BEAMS

4. Shall not have in Volume 1 sound knots greater in diameter than one-fourth the width of the face on which they appear—maximum knot 1½″. Shall not have in Volume 2 sound knots greater in diameter than one-half the width of the face on which they appear—maximum knot 3 inches.

The aggregate diameter of all knots within the center half of the length of any face shall not exceed the width of that face.

The diameter of a knot on the narrow or horizontal face of a beam is to be taken as its projection on a line perpendicular to the edge of the timber. On the wide or vertical face, the smallest dimension of a knot is to be taken as its diameter.

The Great Southern Lumber Company's Administrative Headquarters at BOGALUSA

RESTRICTIONS ON KNOTS IN COLUMNS

5. Shall not have sound knots greater in diameter than one-third the least width of the column—maximum knots 4 inches.

RESTRICTIONS ON SHAKES AND CHECKS IN BEAMS

6. Round or ring shakes shall not occupy, at either end of a timber, more than one-fourth the width of green material, nor more than one-third the width of seasoned material.

Any combination of checks and shakes which would reduce the strength to a greater extent than the allowable round shakes will not be permitted. Shakes shall not show on the faces of either green or seasoned timber.

RESTRICTIONS ON CROSS GRAIN IN BEAMS.

Shall not have diagonal grain with slope greater than one in twenty in Volume 1.

Merchantable Timbers

May be either dense or sound pine.

All merchantable timbers shall be well manufactured and conform to the General Timber Specifications.

Sizes under 9″ on the largest dimension shall show two-thirds or more heart surface on one of the wide faces; sizes 9″ and over on the largest dimension shall show two-thirds or more heart on both of the wide faces. When sticks are square the face showing the most heart shall govern the inspection on sizes under 9″, and the two faces showing the most heart shall govern the inspection when 9″ and over. Heart showing the full length, even if not two-thirds of the area as above, shall meet the requirements of this quality.

Wane not exceeding one-eighth of the dimension of the face and one-quarter of the length of the piece on one corner, or the equivalent on two or more corners on not to exceed ten per cent of the pieces, shall be admitted.

Square Edge and Sound Timbers

May be either dense or sound pine.

Square edge and sound timbers shall be well manufactured and conform to the General Timber Specifications, admitting sound knots, and shall be free from wane.

No. 1 Common Timbers

May be either dense or sound pine.

Common timbers, rough 4x4 and larger, shall not be more than $\frac{1}{4}$″ scant at any point when green, and be well manufactured, and may have $1\frac{1}{2}$″ wane on one corner one-third the length of the piece, or its equivalent on two or more corners; the wane measured on its face.

Timbers 10x10 in size may have 2″ wane as above; the larger sizes may have wane as above in proportion to sizes.

The diameter of any one knot shall not exceed 2″ in 4x4 to 6x6; $2\frac{1}{2}$″ in 6x8 to 8x10; 3″ in 10x10 to 10x12; $3\frac{1}{2}$″ in 12x12 to 12x14; 4″ in 14x14 to 14x16; $4\frac{1}{2}$″ in 16x16 to 16x18. In sizes not mentioned the diameter of knots admissible will increase or decrease in proportion to the size of the timbers on same basis as above specified.

In determining the size of knots, mean or average diameter shall be taken, or the equivalent of the above in grouped knots at any one point. Shakes one-sixth the length of the piece, small unsound knots and a limited number of pin worm holes, well scattered, are admissible.

Standard Specifications for Southern Yellow Pine Bridge and Trestle Timbers*

(To be applied to single sticks and not to composite members.)

General Requirements

1. Except as noted, all timber shall be sound, sawed to standard size, full length, square cornered and straight; shall be close grained and free from defects such as injurious ring shakes and cross grain, unsound or loose knots, knots in groups, decay, or other defects that will materially impair its strength.

Standard Size

2. Rough timbers sawed to standard size means that they shall not be over one-fourth (1/4) in. scant from the actual size specified. For instance, a twelve by twelve (12x12) in. timber shall measure not less than eleven and three-fourths by eleven and three-fourths (11 3/4x11 3/4) in.

Standard Dressing

3. Standard dressing means that not more than one-fourth (1/4) in. shall be allowed for dressing each surface. For instance, a twelve by twelve (12x12) in. timber, after being dressed on four sides, shall measure not less than eleven and one-half by eleven and one-half (11 1/2x11 1/2) in.

STANDARD HEART GRADE, LONGLEAF YELLOW PINE

4. Stringers shall show not less than eighty-five (85) per cent heart on the girth anywhere in the length of the piece; provided, however, that if the maximum amount of sap is shown on either narrow face of the stringer, the average depth of sap shall not exceed one-half (1/2) in. Knots greater than one and one-half (1 1/2) in. in diameter will not be permitted at any section within four (4) in. of the edge of the piece, but knots shall in no case exceed four (4) in. in their largest diameter.

5. Caps and sills shall show not less than eighty-five (85) per cent heart on each of the four sides, measured across the sides anywhere in the length of the piece, to be free from knots over two and one-half (2 1/2) in. in diameter.

6. Posts shall show not less than seventy-five (75) per cent heart on each of the four sides, measured across the sides anywhere in the length of the piece, and to be free from knots over two and one-half (2 1/2) in. in diameter.

WOODEN BRIDGES AND TRESTLES

7. Longitudinal Struts and Girts. One side shall show all heart; the other side shall show not less than eighty-five (85) per cent heart, measured across the side anywhere in the length of the piece, and shall be free from any large knots or other defects that will materially injure its strength.

8. Longitudinal X Braces, Sash Braces and Sway Braces shall show four square corners and not less than eighty (80) per cent heart on each of two sides, and shall be free from any large knots or other defects that will materially injure their strength.

9. Ties and Guard Rails shall show one side all heart; the other side and two edges shall show not less than seventy-five (75) per cent heart, measured across the surface anywhere in the length of the piece; shall be free from any large knots or other defects that will materially injure its strength; and where surfaced the remaining rough face shall show all heart.

STANDARD GRADE, LONGLEAF AND SHORTLEAF YELLOW PINE

10. Stringers shall be square cornered, with the exception of one (1) in. wane on one corner or one-half (1/2) in. wane on two corners. Knots shall not exceed in their largest diameter one-fourth (1/4) of the width of the surface of the stick in which they occur, and shall in no case exceed four (4) in. Ring shakes shall not extend over one-eighth (1/8) of the length of the piece.

11. Caps and Sills shall be square cornered, with the exception of one (1) in. wane on one corner, or one-half (1/2) in. wane on two corners. Knots shall not exceed in their largest diameter one-fourth (1/4) of the width of the surface of the stick in which they occur, and in no case shall exceed four (4) in. Ring shakes shall not extend over one-eighth (1/8) of the length of the piece.

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*Adopted by American Railway Engineering Association. See proceedings, Vol. 10, Part 1, 1909, pp. 537, 539–541, 598–603; Vol. 11, 1910, Part 1, pp. 176, 180, 181, 228–230. Association Manual, 1911 edition, pp. 141–143.

12. Posts shall be square cornered, with the exception of one (1) in. wane on one corner, or one-half (½) in. wane on two corners. Knots shall not exceed, in their largest diameter, one-fourth (¼) of the width of the surface of the stick in which they occur, and shall in no case exceed four (4) in. Ring shakes shall not extend over one-eighth (⅛) of the length of the piece.

13. Longitudinal Struts and Girts shall be square cornered and sound, and shall be free from any large knots or other defects that will materially injure their strength.

14. Longitudinal X Braces, Sash Braces and Sway Braces shall be square cornered and sound, and shall be free from any large knots or other defects that will materially injure their strength.

EXPLANATORY NOTE FOR STANDARD HEART GRADE

These specifications state the maximum limit of sap wood which will be accepted. In practice, with good inspection, the effect of these specifications should be to secure timber the bulk of which is practically all heart. In permanent bridge timber, not protected from decay, sapwood is not only useless in itself, but by furnishing a lodgment for the spores of fungi it is the cause of starting and promoting the continuance of rot in the heart. Sapwood, especially after decay has set in, is also extremely susceptible to fire, while with precautions ordinarily exercised heartwood is practically immune from this source of danger.

On the other hand, for ordinary commercial purposes sapwood is as valuable as heart. Therefore, if the mill owners understand what is wanted, good heart timber can be obtained for a small advance in price over what is usually furnished, much of which contains in bulk 50 per cent or more of sap wood.

To obtain proper results inspection should be made at the mills, where unsatisfactory timber can be rejected without hardship to the mill owner. Extensive buyers of timber should have inspectors stationed at the mills. To cover the needs of smaller buyers and municipalities, it seems that some of the established inspection companies might maintain an organization of timber inspectors at the mills, which would prove profitable to themselves, satisfactory to the mill owners and of incalculable benefit to those who use the timber.

Working Unit Stresses, Load Limits, etc., for Southern Yellow Pine

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR SOUTHERN YELLOW PINE BEAMS LIMITED BY RESISTANCE TO HORIZONTAL SHEAR ALONG THE NEUTRAL AXIS

(Actual Size)

Nominal Size	Actual Size	Horizontal Shearing Stress in Pounds per Square Inch				
		100 #	125 #	150 #	175 #	200 #
2 x 4	1⅝ x 3⅝	784	980	1176	1372	1568
4 x 4	3⅝ x 3⅝	1752	2190	2628	3066	3504
4 x 4	3½ x 3½	1632	2040	2448	2856	3264
2 x 6	1⅝ x 5⅝	1220	1525	1830	2135	2440
2½ x 6	2¼ x 5½	1650	2062	2475	2887	3300
3 x 6	2¾ x 5½	2016	2520	3024	3528	4032
4 x 6	3⅝ x 5⅝	2720	3400	4080	4760	5440
6 x 6	5½ x 5½	4032	5040	6048	7056	8064
2 x 8	1⅝ x 7½	1625	2031	2437	2843	3249
2½ x 8	2¼ x 7½	2250	2812	3375	3937	4500
3 x 8	2¾ x 7½	2750	3437	4125	4812	5500
4 x 8	3¾ x 7½	3750	4687	5625	6562	7500
6 x 8	5½ x 7½	5500	6875	8250	9625	11000
8 x 8	7½ x 7½	7500	9375	11250	13125	15000
2 x10	1⅝ x 9½	2058	2572	3087	3601	4116
2½ x10	2¼ x 9½	2850	3562	4275	4987	5700
3 x10	2¾ x 9½	3484	4355	5226	6097	6968
4 x10	3¾ x 9½	4750	5937	7125	8312	9500
6 x10	5½ x 9½	6966	8707	10449	12190	13932
8 x10	7½ x 9½	9500	11875	14250	16625	19000
10 x10	9½ x 9½	12032	15040	18048	21056	24064
2 x12	1⅝ x11½	2492	3115	3738	4361	4984
2½ x12	2¼ x11½	3450	4312	5175	6037	6900
3 x12	2¾ x11½	4216	5270	6324	7378	8432
4 x12	3¾ x11½	5750	7187	8625	10062	11500
6 x12	5½ x11½	8432	10540	12648	14756	16864
8 x12	7½ x11½	11500	14375	17250	20125	23000
10 x12	9½ x11½	14566	18207	21849	25490	29132
12 x12	11½ x11½	17632	22040	26448	30856	35264

Nominal Size	Actual Size	Horizontal Shearing Stress in Pounds per Square Inch				
		100 #	125 #	150 #	175 #	200 #
2 x14	1¾ x13½	3150	3937	4725	5512	6300
2½ x14	2¼ x13½	4050	5062	6075	7087	8100
3 x14	2¾ x13½	4950	6187	7425	8662	9900
4 x14	3¾ x13½	6750	8437	10125	11812	13500
6 x14	5½ x13½	9900	12375	14875	17325	19800
8 x14	7½ x13½	13500	16875	20250	23625	27000
10 x14	9½ x13½	17100	21375	25650	29925	34200
12 x14	11½ x13½	20700	25875	31050	36225	41400
14 x14	13½ x13½	24300	30375	36450	42525	48600
2 x16	1¾ x15½	3616	4520	5424	6328	7232
2½ x16	2¼ x15½	4650	5812	6975	8137	9300
3 x16	2¾ x15½	5684	7105	8526	9947	11368
4 x16	3¾ x15½	7750	9687	11625	13562	15500
6 x16	5½ x15½	11366	14207	17049	19890	22732
8 x16	7½ x15½	15500	19375	23250	27125	31000
10 x16	9½ x15½	19634	24542	29451	34359	39268
12 x16	11½ x15½	23766	29707	35649	41590	47532
14 x16	13½ x15½	27900	34875	41850	48825	55800
16 x16	15½ x15½	32032	40040	48048	56056	64064
2 x18	1¾ x17½	4084	5105	6126	7147	8168
2½ x18	2¼ x17½	5250	6562	7875	9187	10500
3 x18	2¾ x17½	6416	8020	9624	11228	12832
4 x18	3¾ x17½	8750	10937	13125	15312	17500
6 x18	5½ x17½	12834	16042	19251	22459	25668
8 x18	7½ x17½	17500	21875	26250	30625	35000
10 x18	9½ x17½	22166	27707	33249	38790	44332
12 x18	11½ x17½	26834	33542	40251	46959	53668
14 x18	13½ x17½	31500	39375	47250	55125	63000
16 x18	15½ x17½	36166	45207	54249	63290	72332
18 x18	17½ x17½	40832	51040	61248	71456	81664
20 x20	19½ x19½	50700	63375	76050	88725	101400

SOUTHERN YELLOW PINE POSTS

(Actual Size)

SAFE LOADS IN TONS OF 2000 POUNDS

SAFE STRENGTH IN POUNDS PER INCH

For Various Values of l/d.

Square End Bearing and Symmetrically Loaded.

Nominal Size Inches	Actual Size Inches	Area Sq. In.	l/d	Length in Feet	Compression Parallel to the Grain Pounds per Sq. In.			
					1000	1100	1300	1500
6x 6	5½x 5½	30¼	17.5	8	11.82	13.00	15.36	17.72
6x 6	5½x 5½	30¼	21.8	10	11.01	12.11	14.31	16.51
6x 6	5½x 5½	30¼	26.2	12	10.18	11.19	13.23	15.27
6x 6	5½x 5½	30¼	30.5	14	9.35	10.29	12.15	14.01
8x 8	7½x 7½	56¼	12.8	8	23.64	26.00	30.73	35.45
8x 8	7½x 7½	56¼	16.0	10	22.50	24.75	29.25	33.75
8x 8	7½x 7½	56¼	19.2	12	21.37	23.51	27.79	32.07
8x 8	7½x 7½	56¼	22.4	14	20.25	22.27	26.31	30.35
8x 8	7½x 7½	56¼	25.6	16	19.12	21.03	24.85	28.67
8x 8	7½x 7½	56¼	28.8	18	18.00	19.80	23.40	27.00
8x 8	7½x 7½	56¼	32.0	20	16.87	18.56	21.94	25.32
10x10	9½x 9½	90¼	10.1	8	39.42	43.36	51.24	59.13
10x10	9½x 9½	90¼	12.6	10	38.03	41.83	49.43	57.05
10x10	9½x 9½	90¼	15.2	12	36.55	40.20	47.51	54.82
10x10	9½x 9½	90¼	17.7	14	35.20	38.72	45.76	52.80
10x10	9½x 9½	90¼	20.2	16	33.84	37.22	43.99	50.75
10x10	9½x 9½	90¼	22.7	18	32.32	35.55	42.01	48.48
10x10	9½x 9½	90¼	25.3	20	30.85	33.93	40.10	46.27
12x12	11½x11½	132¼	8.3	8	59.51	65.46	77.36	89.26
12x12	11½x11½	132¼	10.4	10	57.53	63.28	74.78	86.29
12x12	11½x11½	132¼	12.5	12	55.78	61.36	72.52	83.68
12x12	11½x11½	132¼	14.6	14	54.10	59.51	70.33	81.15
12x12	11½x11½	132¼	16.7	16	52.24	57.46	67.91	78.35
12x12	11½x11½	132¼	18.8	18	50.58	55.64	65.76	75.88
12x12	11½x11½	132¼	20.9	20	48.93	53.82	63.60	73.39
14x14	13½x13½	182¼	7.1	8	82.93	91.22	107.80	124.39
14x14	13½x13½	182¼	8.9	10	81.10	89.21	105.43	121.65
14x14	13½x13½	182¼	10.7	12	79.27	87.20	103.06	118.91
14x14	13½x13½	182¼	12.4	14	76.96	84.65	100.04	115.43
14x14	13½x13½	182¼	14.2	16	74.97	82.46	97.46	112.46
14x14	13½x13½	182¼	16.0	18	72.90	80.19	94.77	109.35
14x14	13½x13½	182¼	17.8	20	71.07	78.18	92.40	106.62
16x16	15½x15½	240¼	6.2	8	110.84	121.92	144.09	166.25
16x16	15½x15½	240¼	7.7	10	109.00	119.90	141.70	163.50
16x16	15½x15½	240¼	9.3	12	106.15	116.76	137.99	159.22
16x16	15½x15½	240¼	10.8	14	103.86	114.24	135.01	155.78
16x16	15½x15½	240¼	12.4	16	101.44	111.58	131.87	152.15
16x16	15½x15½	240¼	14.0	18	99.05	108.95	128.76	148.57
16x16	15½x15½	240¼	15.5	20	96.86	106.55	125.92	145.29
18x18	17½x17½	306¼	5.5	8	142.55	156.80	185.31	213.82
18x18	17½x17½	306¼	6.9	10	139.90	153.89	181.87	209.85
18x18	17½x17½	306¼	8.2	12	137.54	151.29	178.80	206.31
18x18	17½x17½	306¼	9.6	14	134.75	148.22	175.17	202.12
18x18	17½x17½	306¼	11.0	16	132.11	145.32	171.74	198.16
18x18	17½x17½	306¼	12.3	18	129.74	142.71	168.66	194.60
18x18	17½x17½	306¼	13.7	20	127.09	139.80	165.22	190.64

l/d	Compression Parallel to the Grain Pounds per Square Inch					
	1000	1100	1200	1300	1400	1500
5	938	1031	1125	1219	1312	1406
6	925	1017	1109	1202	1295	1387
7	913	1004	1095	1186	1277	1369
8	900	990	1080	1170	1260	1350
9	887	975	1064	1153	1242	1331
10	875	962	1050	1137	1225	1312
11	862	948	1034	1120	1206	1292
12	850	935	1020	1105	1190	1275
13	837	921	1005	1089	1173	1257
14	825	907	990	1072	1155	1237
15	812	893	974	1055	1136	1217
16	800	880	960	1040	1120	1200
17	787	866	945	1024	1103	1182
18	775	853	930	1008	1085	1163
19	762	838	914	990	1066	1142
20	750	825	900	975	1050	1125
21	737	811	885	958	1031	1105
22	725	798	870	943	1015	1088
23	712	784	855	926	997	1068
24	700	770	840	910	980	1050
25	687	756	824	893	961	1030
26	675	743	810	878	945	1013
27	662	728	794	860	926	992
28	650	715	780	845	910	975
29	637	701	765	829	893	957
30	625	687	750	812	875	937

FORMULA

Unit strength per square inch $= C\ (1 - l/80d)$

C = compressive strength per square inch with the grain.

l = length of post in inches.

d = least diameter in inches.

PROPERTIES AND MAXIMUM BENDING MOMENTS (IN FOOT POUNDS) FOR SOUTHERN YELLOW PINE BEAMS

Nominal Size	Actual Size	Dressed	Area of Section Sq. Ins.	Weight per Foot Pounds	Moment of Inertia Inches	Section Modulus Inches	Coefficient of Deflection Uniform Load Inches	MAXIMUM BENDING MOMENT IN FOOT LBS.			
								Fibre Stress 1200 # Per Sq. In.	Fibre Stress 1300 # Per Sq. In.	Fibre Stress 1500 # Per Sq. In.	Fibre Stress 1800 # Per Sq. In.
2 x 4	1⅝x 3⅝	S1S1E	5.89	1.63	6.45	3.56	.0021533	356	385	444	534
4 x 4	3⅝x 3⅝	S1S1E	13.14	3.64	14.39	7.94	.0009652	794	860	992	1190
4 x 4	3½x 3½	S4S	12.25	3.40	12.50	7.15	.0011106	715	774	893	1072
2 x 6	1⅝x 5⅝	S1S1E	9.14	2.53	24.10	8.57	.0005763	857	928	1071	1285
2½x 6	2¼x 5½	S1S1E	12.37	3.43	31.18	11.34	.0006078	1134	1228	1417	1701
3 x 6	2¾x 5½	S1S1E	15.12	4.20	38.13	13.86	.0003643	1386	1501	1732	2079
4 x 6	3⅝x 5⅝	S1S1E	20.39	5.65	53.76	19.12	.0002583	1912	2071	2390	2868
6 x 6	5½x 5½	S4S	30.25	8.38	76.25	27.73	.0001821	2773	3004	3466	4159
2 x 8	1⅝x 7½	S1S1E	12.19	3.38	57.13	15.23	.0002431	1523	1650	1904	2284
2½x 8	2¼x 7½	S1S1E	16.87	4.68	79.10	21.10	.0001756	2110	2285	2637	3165
3 x 8	2¾x 7½	S1S1E	20.62	5.72	96.68	25.78	.0001437	2578	2793	3222	3867
4 x 8	3¾x 7½	S1S1E	28.12	7.80	131.83	35.16	.00010535	3516	3809	4395	5174
6 x 8	5½x 7½	S1S1E	41.25	11.43	193.36	51.56	.00007183	5156	5585	6445	7734
8 x 8	7½x 7½	S4S	56.25	15.58	263.67	70.31	.00005268	7031	7616	8787	10545
2 x10	1⅝x 9½	S1S1E	15.44	4.28	116.10	24 44	.0001197	2444	2648	3055	3666
2½x10	2¼x 9½	S1S1E	21.37	5.92	160.76	33.84	.0000864	3384	3666	4230	5076
3 x10	2¾x 9½	S1S1E	26.12	7.24	196.48	41.36	.00007069	4136	4480	5170	6204
4 x10	3¾x 9½	S1S1E	35.62	9.87	267.93	56.41	.00005184	5641	6110	7050	8461
6 x10	5½x 9½	S4S	52.25	14.47	392.96	82.73	.00003534	8273	8962	10341	12409
8 x10	7½x 9½	S4S	71.25	19.74	535.86	112.81	.00002592	11281	12221	14100	16921
10 x10	9½x 9½	S4S	90.25	25.00	678.75	142.89	.00002046	14289	15480	17862	21435
2 x12	1⅝x11½	S1S1E	18.69	5.18	205.95	35.82	.00006744	3582	3880	4477	5373
2½x12	2¼x11½	S1S1E	25.87	7.17	285.16	49.59	.00004871	4958	5371	6197	7436
3 x12	2¾x11½	S1S1E	31.62	8.76	348.53	60.61	.00003985	6060	6565	7575	9090
4 x12	3¾x11½	S1S1E	43.12	11.95	475.27	82.66	.00002922	8266	8955	10332	12399
6 x12	5½x11½	S4S	63.25	17.52	697.07	121.23	.00001993	12123	13133	15153	18185
8 x12	7½x11½	S4S	86.25	23.89	950.55	165.31	.00001461	16531	17908	20664	24796
10 x12	9½x11½	S4S	109.25	30.26	1204.03	209.39	.00001154	20939	22683	29174	31408
12 x12	11½x11½	S4S	132.25	36.63	1457.51	253.48	00000953	25348	27460	31684	38020
2 x14	1¾x13½	S1S1E	23.62	6.55	358.80	53.16	.00003871	5316	5759	6645	7974
2½x14	2¼x13½	S1S1E	30.37	8.41	461.32	68.34	.00003011	6834	7403	8542	10251
3 x14	2¾x13½	S1S1E	37.12	10.28	563.84	83.53	.00002463	8353	9049	10441	12529
4 x14	3¾x13½	S1S1E	50.62	14.02	768.87	113.91	.00001806	11391	12340	14238	17086
6 x14	5½x13½	S4S	74.25	20.57	1155.17	167.10	.00001232	16710	18102	20887	25065
8 x14	7½x13½	S4S	101.25	28.05	1537.73	227.81	.00000903	22781	24679	28476	34174
10 x14	9½x13½	S4S	128.25	35.53	1947.80	288.56	.00000713	28856	31261	36071	43284
12 x14	11½x13½	S4S	155.25	43.00	2357.86	349 31	.00000589	34931	37841	43664	52396
14 x14	13½x13½	S4S	182.25	50.48	2767.92	410.06	.00000502	41006	44423	51257	61508
2 x16	1¾x15½	S1S1E	27.12	7.51	543.06	70.10	.00002557	7010	7594	8762	10515
2½x16	2¼x15½	S1S1E	34.87	9.66	698.23	90.10	.00001989	9010	9760	11262	13515
3 x16	2¾x15½	S1S1E	42.62	11.81	853.39	110.11	.00001628	11011	11928	13763	16516
4 x16	3¾x15½	S1S1E	58.12	16.10	1163.71	150.16	.00001193	15016	16267	18770	22524
6 x16	5½x15½	S4S	85.25	23.61	1706.78	220.23	.00000814	22023	23858	27528	33033
8 x16	7½x15½	S4S	116.25	32.20	2327.42	300.31	.00000597	30031	32533	37538	45046
10 x16	9½x15½	S4S	147.25	40.79	2948.07	380.39	.00000471	38039	41208	47548	57058
12 x16	11½x15½	S4S	178.25	49.37	3568.71	460.48	.00000389	46048	49885	57560	69072
14 x16	13½x15½	S4S	209.25	57.96	4189.36	540.56	.00000332	54056	58560	67569	81084
16 x16	15½x15½	S4S	240.25	66.55	4810.00	620.65	.00000289	62065	67237	77581	93097
2 x18	1¾x17½	S1S1E	30.62	8.48	781.57	89.32	.00001777	8932	9676	11165	13398
2½x18	2¼x17½	S1S1E	39.37	10.91	1004.88	114.84	.00001382	11484	12441	14355	17226
3 x18	2¾x17½	S1S1E	48.12	13.33	1228.19	140.36	.00001131	14036	15205	17545	21054
4 x18	3¾x17½	S1S1E	65.62	18.18	1674.80	191.41	.00000829	19141	20736	23926	28711
6 x18	5½x17½	S4S	96.25	26.66	2456.38	280.73	.00000565	28073	30412	35091	42109
8 x18	7½x17½	S4S	131.25	36.36	3349.61	382.81	.00000415	38281	41471	47850	57421
10 x18	9½x17½	S4S	166.25	46.05	4242.84	484.89	.00000327	48489	52530	60612	72734
12 x18	11½x17½	S4S	201.25	55.75	5136.07	586.98	.00000270	58698	63590	73373	88047
14 x18	13½x17½	S4S	236.25	65.44	6029.29	689.06	.00000230	68906	74648	86133	103359
16 x18	15½x17½	S4S	271 25	75.14	6922.53	791.14	.00000201	79114	85706	98892	118671
18 x18	17½x17½	S4S	306.25	84.83	7815.76	893.23	.0000178	89322	96765	111652	133982
20 x20	19½x19½	S4S	380.25	105.33	12049.17	1235.81	.00000115	123580	133878	154475	185370

"Actual size" indicates the size of the dressed timber and dressed as indicated. "S1S1E" indicates that the piece is "dressed on one side and one edge." "S4S" indicates that the piece is "dressed on four sides."

The weight of the section is based on a weight of 40 pounds per cubic foot.

The moment of inertia and section modulus are with the neutral axis perpendicular to the depth at the center.

The coefficient of deflection is the deflection in inches of a beam one foot long with a uniformly distributed load of 1,000 pounds. The deflection of a beam of any span and uniform load is obtained by multiplying the proper coefficient by the cube of the span in feet and by the number of 1,000-pound units in given load. For a concentrated load of 1,000 pounds applied at the center of the span the coefficient for such loading is 1.6 times the given coefficient. For a load of 1,000 pounds applied at the third points of the span in 500 pound units the coefficient for such loading is 1.36 times the given coefficient.

WOODEN BRIDGES AND TRESTLES*

WORKING UNIT-STRESSES FOR STRUCTURAL TIMBER USED IN WOODEN BRIDGES AND TRESTLES†

[Expressed In Pounds Per Square Inch.]

KIND OF TIMBER	BENDING: Extreme Fibre Stress — Average Ultimate	BENDING: Extreme Fibre Stress — Working Stress	BENDING: Modulus of Elasticity — Average	SHEARING: Parallel to the Grain — Average Ultimate	SHEARING: Parallel to the Grain — Working Stress	SHEARING: Longitudinal Shear in Beams — Average Ultimate	SHEARING: Longitudinal Shear in Beams — Working Stress	COMPRESSION: Perpendicular to the Grain — Elastic Limit	COMPRESSION: Perpendicular to the Grain — Working Stress	COMPRESSION: Parallel to the Grain — Average Ultimate	COMPRESSION: Parallel to the Grain — Working Stress	COMPRESSION: For Columns under 15 Diams. Working Stress	COMPRESSION: Formulas for Working Stress in Long Columns over 15 Diameters	Ratio of Length of Stringer to Depth
Longleaf Pine	6500	1300	1 610 000	720	180	300	120	520	260	3800	1300	980	$1300(1-l/60d)$	10
Douglas Fir	6100	1200	1 510 000	690	170	270	110	630	310	3600	1200	900	$1200(1-l/60d)$	10
Shortleaf Pine	5600	1100	1 480 000	710	170	330	130	340	170	3400	1100	830	$1100(1-l/60d)$	10
White Pine	4400	900	1 130 000	400	100	180	70	290	150	3000	1000	750	$1000(1-l/60d)$	10
Spruce	4800	1000	1 310 000	600	150	170	70	370	180	3200	1100	830	$1100(1-l/60d)$	
Norway Pine	4200	800	1 190 000	‡590	130	250	100	——	150	‡2600	800	600	$800(1-l/60d)$	
Tamarack	4600	900	1 220 000	670	170	260	100	——	220	‡3200	1000	750	$1000(1-l/60d)$	
Western Hemlock	5800	1100	1 480 000	630	160	‡270	100	440	220	3500	1200	900	$1200(1-l/60d)$	
Redwood	5000	900	800 000	300	80	——	——	400	150	3300	900	680	$900(1-l/60d)$	
Bald Cypress	4800	900	1 150 000	500	120	——	——	340	170	3900	1100	830	$1100(1-l/60d)$	
Red Cedar	4200	800	800 000	——	——	——	——	470	230	2800	900	680	$900(1-l/60d)$	
White Oak	5700	1100	1 150 000	840	210	270	110	920	450	3500	1300	980	$1300(1-l/60d)$	12

*—Adopted by American Railway Engineering Association, 1909. See association proceedings, Vol. 10, pp. 537, 564, 609–611. These unit-stresses are for a green condition of timber and are to be used without increasing the live load stresses for impact.

†—Green Timber in Exposed Work.

‡—Partially air-dry.

l—Length in inches.

d—Least side in inches.

NOTE.—The working unit-stresses given in this table are intended for railroad bridges and trestles. For highway bridges and trestles the unit-stresses may be increased twenty-five (25) per cent. *For buildings and similar structures, in which the timber is protected from the weather and practically free from impact, the unit-stresses may be increased fifty (50) per cent.* To compute the deflection of a beam under long-continued loading instead of that when the load is first applied, only fifty (50) per cent of the corresponding modulus of elasticity given in the table is to be employed.

A VISUAL METHOD OF DISTINGUISHING LONGLEAF PINE*

By Arthur Koehler, Expert in Wood Identification,
Forest Products Laboratory, U. S. Forest Service, Madison, Wis.

A detailed study of the wood of longleaf (*Pinus palustris*), loblolly (*Pinus taeda*), and shortleaf (*Pinus echinata*) pines has recently been made at the Forest Products Laboratory, Madison, Wis., for the purpose of determining if differences could be found by which the botanical species can always be distinguished. Previously no absolutely reliable means of identification had been known. A number of characteristic features were discovered in each species and, as far as observations have been made, they bid fair to distinguish positively between the species. Although the grading of structural timbers has lately been placed on a basis of density (shown by rate of growth and percent of summerwood), irrespective of species, yet it is often desirable to know the botanical name of a specimen.

SIZE OF PITH AND OF SECOND ANNUAL RING

Of chief interest to lumbermen is a difference in the size of the pith of these pines, because this feature can be observed without a microscope.

The pith of longleaf has been found to be over 0.10 inch in diameter in all normal specimens examined while in loblolly and shortleaf it was found to be less, except in specimens of vigorous growth. The vigor of the tree at the time the pith was formed in any part of the stem is indicated

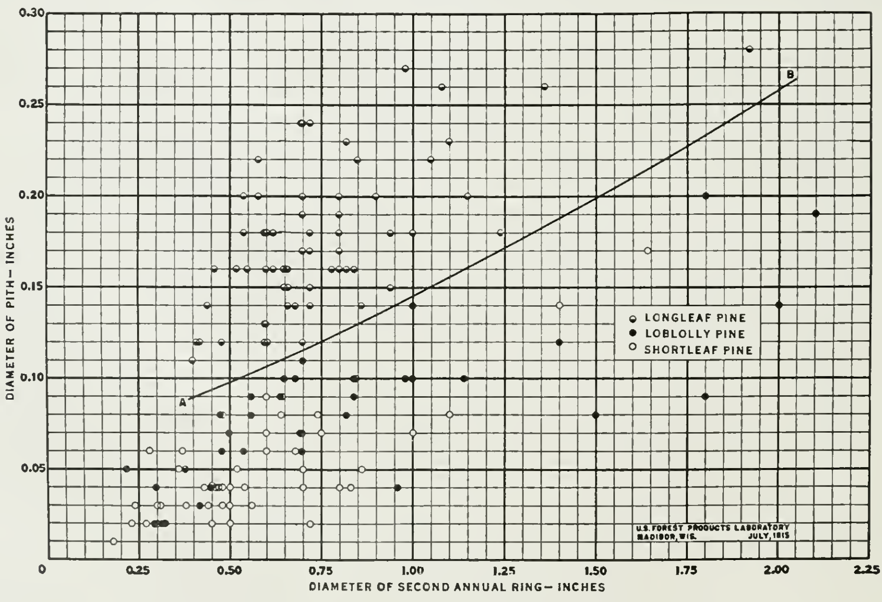

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FIG 1.—RELATION OF DIAMETER OF PITH TO DIAMETER OF SECOND ANNUAL RING IN EACH SPECIES

*An article that appeared in the AMERICAN LUMBERMAN (Chicago) and the ENGINEERING RECORD (New York) September 11, 1915. The test here described applied to BOGALUSA BRAND STRUCTURAL TIMBERS will invariably demonstrate that they are GENUINE LONG LEAF PINE.

by the diameter of the first few annual rings surrounding the pith at that point. Therefore it was found that by taking the diameter of the second annual ring into consideration, together with the diameter of the pith, longleaf can also be separated from shortleaf and loblolly even when the latter have a pith over 0.10 inch in diameter. So far no exceptions have been found to the rule.

The illustrated diagram herewith (Fig. 1) shows the diameter of the pith of each species plotted against the diameter of the second annual ring. Each circle represents a separate tree. From the diagram it will be seen that whenever the pith in loblolly or shortleaf was found to be over 0.10 inch in diameter the diameter of the second annual ring was considerably larger than that found in longleaf having the same sized pith. The line (AB) was drawn so that those points that fall above the line represent longleaf and those that fall below it represent loblolly or shortleaf.

Fig. 2.—Transverse surface of a piece of longleaf pine showing pith (P), limit of second annual ring (A.R.), and leaf-trace (L.T.) Natural size.

The diameter of the second annual ring was chosen for these measurements because it gave more satisfactory results in separating the species than the first annual ring alone.

In longleaf, even in slow-growing specimens, the first annual ring is comparatively large (see Fig. 3). This is evident from the fact that the yearly shoots are nearly always coarser in this species than in loblolly and shortleaf. Therefore, in specimens having a pith 0.11 inch or a little more in diameter the first annual ring of shortleaf or loblolly (fairly rapid growth) is only slightly larger than the first annual ring of longleaf (slow growth). The second annual ring in such specimens, however, is quite narrow in longleaf and fairly wide in the other two species, thus adding to the degree of separation. (It will be noticed that the diameter of the second annual ring includes the first also and is not the difference between the two.) Rings farther out were not considered, because they do not indicate as well the vigor of the tree at the time the pith was formed.

A careful analysis of the data obtained shows that out of 127 specimens of longleaf, representing eighty-three different trees, no pith was found less than 0.11 inches in diameter except in two specimens that were cut at a point where a whorl of branches joined the stem. Out of 110 specimens of shortleaf, representing sixty-six different trees, only fifteen had a pith over 0.10 inches in diameter. Out of sixty-four specimens of loblolly, representing forty-seven different trees, twenty had a pith over 0.10 inches in diameter. Usually the pith in shortleaf and slow-growing loblolly was about 0.08 inch or a little less in diameter. (The "lead" in an ordinary lead pencil is about 0.08 or 0.09 inch in diameter and can be used for comparison.) In general the pith is smallest at the stump, becomes rapidly larger upward and decreases again in the crown. All of the specimens studied were botanically identified by the leaves or cones.

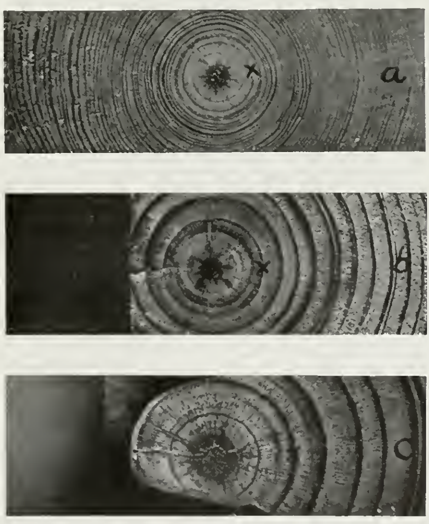

Fig. 3.—Longleaf pine—a, slow; b, medium; c, rapid growth near center; x, second annual ring. Actual size.

HOW TO MEASURE PITH AND SECOND ANNUAL RING

The pith of the pines can be readily recognized as a small, darker and softer core in the structural center of the stem. The second annual ring is clearly defined by a distinct darker line (see Fig. 2), but sometimes the first annual ring is rather faint, and care must be taken not to mistake the third annual ring for the second. Occasionally dark bands, or false rings, are found in the wood (see first and second rings of Fig. 4), but these can be distinguished from true annual rings by the fact that their outer limit is not defined by a sharp line as is always the case with true annual rings. Measurements made on a section where knots join the center of the stem are not reliable for identification. At such points the pith may be unusually small or the rings irregular and the other end of the specimen should be examined. To measure the pith and second annual ring properly it is first necessary to cut with a sharp knife a smooth surface showing these structures. Moistening the wood often brings out the structural features more clearly. With a rule graduated in twenty-fifths or fiftieths of an inch, the average diameter of the pith not including small projections can be measured. A reading glass or low power hand lens is helpful but not essential in making this measurement.

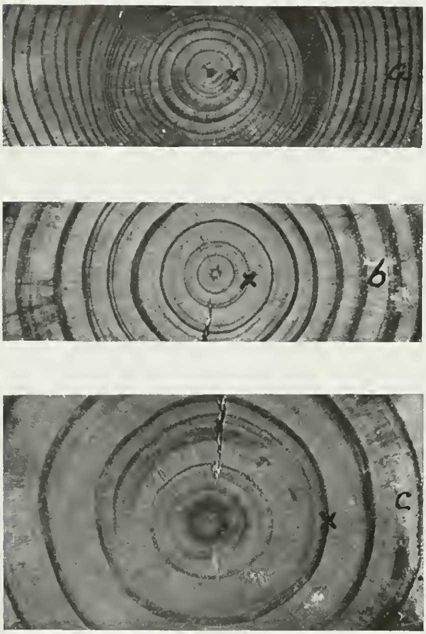

Fig. 4.—Loblolly pine—a, slow; b, medium; c, rapid growth near center; x, second annual ring. Actual size.

If the intersection of the lines on the diagram representing the diameter of the pith and of the second annual ring of a specimen falls below the line (AB) it indicates that the specimen is not longleaf and may be either loblolly or shortleaf. Should the point of intersection fall close to the line (AB) a measurement on the other end of the specimen may result in more definite indications.

Obviously this method of identification can be used only on timbers, ties or other pieces containing the pith, but it is, as a rule, only regarding large pieces that the lumberman or contractor desires to know the exact species. Furthermore, this method does not exclude the minor southern pines, which, however, are comparatively rare in the lumber markets. Occasional pieces of Cuban pine might be classed as longleaf by this method.

MICROSCOPICAL DIFFERENCES

The more minute microscopical distinctions found for these three species can not be given in detail here but will be published in a technical journal. Briefly it may, however, be said that the leaf traces, vertical resin ducts, medullary rays, especially those containing resin ducts, and the ray tracheids afford helpful and dependable criteria for identification of the species.

THE LEAF TRACES

The leaf traces can be seen but not measured with the naked eye in the first and second annual rings where they appear as numerous miniature "knots" (Fig. 2). They are a continuation of the

woody part of the leaf clusters that clothe each year's new growth and persist for several years. The leaf traces like the leaf clusters are largest in longleaf and smallest in shortleaf. In loblolly they are intermediate and overlap the other two species in size.

OTHER CHARACTERS

The vertical resin ducts and the medullary rays containing the horizontal resin ducts also were found to average considerably larger in longleaf than in the other two species. The projections on the walls of the ray tracheids were found to be less reticulate in loblolly, as pointed out by Penhallow in North American Gymnosperms, but this feature was found to be influenced to some extent by the rate of growth.

SUMMARY FOR VISUAL METHOD

1—See if pith is present at ends of stick. (If pith is not present the specimen can not be identified without a microscope.)

2—With sharp knife smooth the pith and surrounding wood. If knots are present at that point try the other end.

3—If the pith is not clear try moistening the smoothed surface.

4—With finely graduated rule carefully measure the average diameter of the pith. Use a reading glass or low power hand lens if available.

5—If the pith is 0.10 inch or less in diameter the specimen is not longleaf.

6—If the pith is over 0.10 inch in diameter also measure the diameter of the second annual ring. Be careful not to mistake the first or third annual ring for the second.

7—On the chart find the point of intersection of the line representing the diameter of the pith with the line representing the diameter of the second annual ring.

8—If this point is below the line (AB) the specimen is not longleaf.

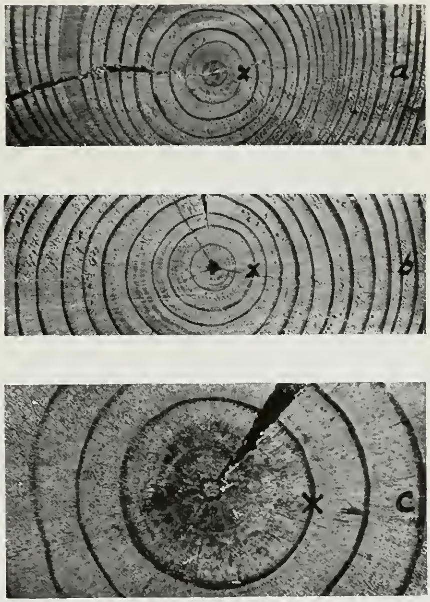

Fig. 5.—Shortleaf pine—a, slow; b, medium; c, rapid growth near center; x, second annual ring. Actual size.

9—If this point is above the line (AB) the specimen is longleaf or, in rare instances, it may be Cuban pine.

10—If the point of intersection is close to the line (AB) make measurements on the other end of the specimen.

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